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ON THE EVOLUTION AND HOMOLOGIES OF THE INCISORS OF THE HORSE.

BY JNO. A. RYDER.

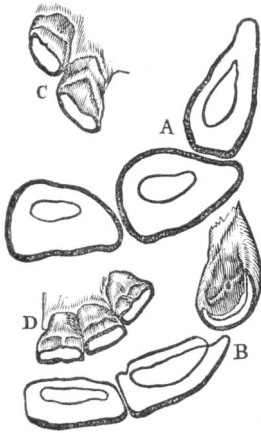
In the course of investigations made to determine the origin of the type of incisors found in the horse, it was noticed that the slightly worn third lower incisor from a horse, not adult, bore a very striking resemblance to the incisors in *Paloplotherium* and *Palæotherium*, which are regarded by Kowalewsky and others as ancestral forms of *Equus*. The tooth in question, which gave a foundation to this supposition, agrees remarkably in form with the incisors of the older genera mentioned, in the form of the posterior basal ridge, which seems to be destined to form the posterior wall of the central pit, or cul-de-sac—"mark" of horsemen. This posterior basal ridge in the third tooth in the state of development at the time of observation, occupied much the same relative position to the space between it and the worn surface in use at the anterior border of the crown, as the supposed homologous ridges in the aforementioned eocene and miocene forms. That the space between the posterior basal ridge and the worn surface functionally in use, is destined to become the central pit or cul-de-sac of the tooth is proved by the condition in which we found the third lower incisor under consideration, and the condition of the second alongside of it. The posterior basal ridge in the third has not yet been reached so as to be worn, and the second still retains marked traces in section of the lateral grooves. These seem to be the remains of the notches that once in bunodont forms separated the tubercles, which formed a festoon (cingulum) above the cervix of the tooth posteriorly, as observed in the upper inner incisor of *Dicotyles*.¹

The posterior basal ridge in this outer lower incisor is also faintly marked off laterally, by a shallow longitudinal groove,

¹ Since writing the above we have had an opportunity of examining in the Zoological Gardens the incisors of a young female donkey, in which the condition of development had not reached the state detailed in the text. Even the inner incisor exhibits, when looked at from above, traces of the parentage of the hinder wall of the cul-de-sac, while the outer one is still more nearly like the same tooth in *Palæotherium*.

from the anterior portion of the tooth, and a slight notch is present in the middle of its crest.

The second incisor above, not yet protruded from the alveolus, has a marked groove running along the posterior face of the tooth longitudinally, a little more than .1 inch from its outer edge where the posterior wall (posterior basal ridge) of the central pit seems to be united with the anterior. There is also a central longitudinal groove in the posterior wall, the wall being slightly inflected along the course of the groove towards the centre of the pit. The posterior wall (posterior basal ridge) is also considerably shorter than the anterior in this tooth, which was observed to be the case in all of the incisor teeth before being protruded from the alveolus.



A. Right upper incisors of adult horse, fully worn, all traces of the basal ridges being obliterated as such, and now bounding the hinder borders of the pits.

B. Left lower incisors of young horse; the first tooth fully worn, the second partly worn, showing the points of junction of the basal ridge with the anterior part of the tooth, while in the third tooth the basal ridge is not yet worn.

C. Second and third upper incisors of *Palæotherium medium*, showing basal ridge. (After Gervais.)

D. Left lower incisors of *Palæotherium minus* with basal ridges. (After Gervais.)

When the worn faces of the teeth are looked at from above, it is observed that the two edges of the enamel plates forming the anterior and posterior faces of the anterior and posterior walls are closer together in the posterior than in the anterior one, showing that the posterior has been the last to be brought under the influence of wear and that the posterior is likewise not as strong nor as fully developed, retaining, as it were, in its weakness, evidence of its later origin. In regard to the homology of the median groove and notch in the posterior wall of the central pit, there seems to be reason for believing that they are the remains of the space separating the lateral posterior oblique basal ridges of the incisors of such unspecialized forms as *Anthracotherium* and many others.

Amongst other perissodactyle mammals, as in *Tapirus*, in the upper incisors the posterior basal ridge is produced and almost as high as the anterior. The space between the two is sub-triangu-

lar, very shallow, convex from side to side, concave antero-posteriorly, and covered with a thick enamel layer. In *Palæotherium* there is a marked internal basal ridge on the canine, which is very slightly marked in the horse. In giraffe, the basal ridge seems to be developed in much the same way as in *Palæotherium*, in the third incisor at least, but has not advanced so high up the posterior face of the tooth.

These facts seem to point to but one conclusion, viz.: that these basal ridges are homologous, and that the space between the anterior wall, the primitive functional part, and the posterior wall (basal ridge), is the rudimentary cul-de-sac, and that sooner or later they are accelerated, becoming functional; or, are retarded, remaining rudimentary or disappearing altogether.

If we regard the dental system of *Equus* as an acceleration of the dental system of the primitive hippoid types, as has been shown by the results of the researches of Professors Leidy and Marsh, a clear explanation is at once afforded of the homologies of the parts of the teeth. The relatively short teeth of the earlier, and the relatively long ones of more recent forms, if we contrast the molars and incisors, seem to indicate that the acceleration was synchronous. The relatively short basal ridges of the early types were produced in a constant ratio with the production of the molar and incisive elements, culminating at last in the relatively complex incisive dentition of modern *Equus*. This view is verified by the embryological history of the teeth in the horse, where we actually have a sort of repetition of the forms of the incisors of earlier types.